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Gas Journal

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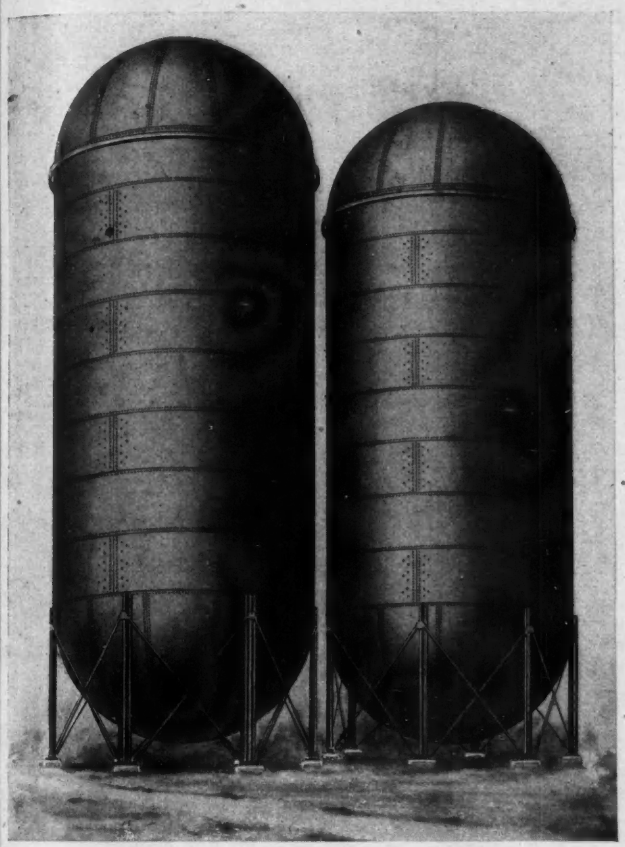

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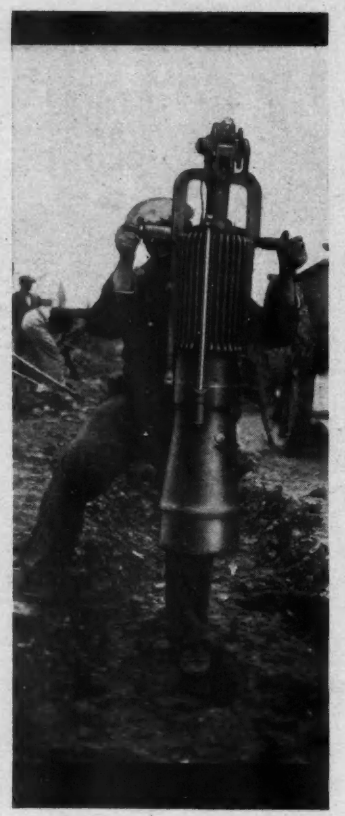

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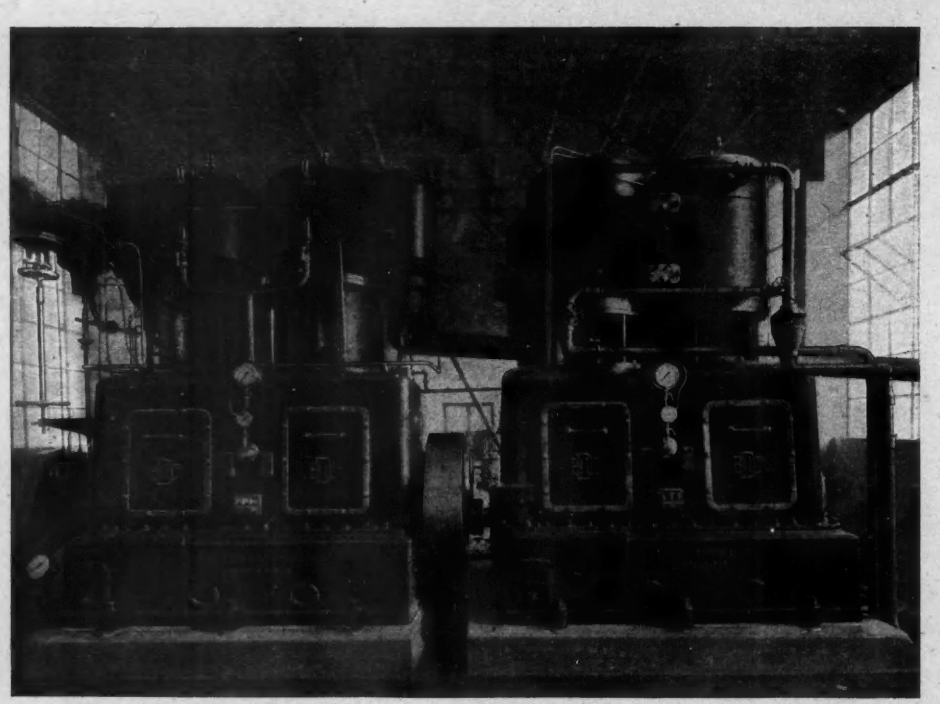

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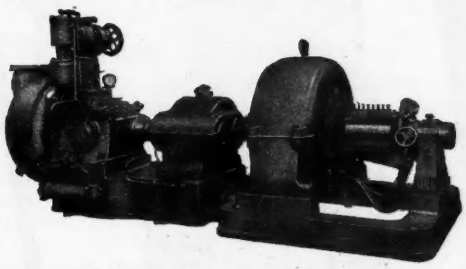

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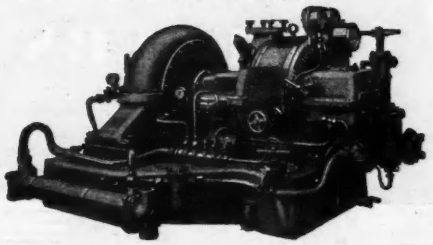

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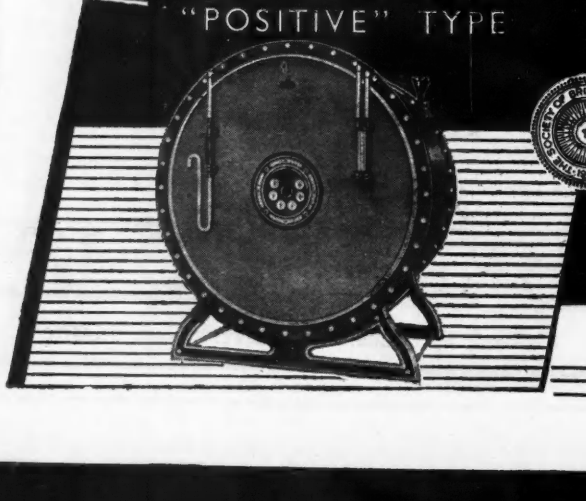

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GAS JOURNAL, AUG. 4, 1943

VOL. 242 95th YEAR No. 4185

EDITORIAL NOTES

HOLDING COMPANIES

THE Association of Gas Corporations, formed to bring about closer co-operation between holding companies, is actively engaged in preparing post-war reconstruction proposals as affecting the 250 gas undertakings which its eleven members control, representing an embarked capital of £25,000,000, and the supply of 41,000 million cu.ft. of gas per annum to 1,400,000 consumers. In recent weeks summarized reports of the annual meetings of several of these holding companies have been published in the "JOURNAL," and, without exception, the speeches of the chairmen have been in most optimistic vein. We think that the progress which has been reported by the various groups can only be regarded with very lively satisfaction, and we feel sure that the measure of integration which they had introduced before the war into the Gas Industry has been a substantial factor in the contribution it has been able to make with increasing measure to the war effort. Considering the unprecedented difficulties and the new situations which have had to be met and coped with, the progress recorded speaks volumes, in more than millions of cubic feet of gas, for the virility of private enterprise, and we hope that due note will have been taken of it in the responsibile governmental quarters. In any case, the holding company movement, which itself would hesitate to claim either that its origins were entirely devoid of self-interest or that it was completely free of the initial mistakes so common to pioneering enterprises, has been the most extensive and rapid spontaneous effort of the Gas Industry to rationalize itself hitherto. The achievements, as well as the faults—indeed, the whole of the facts of the case—are there for all to see and to examine, as a possible part solution of reconstruction problems.

The demand for gas for war purposes has been and remains insistent. There has been the reverse of any seeking of business but the fact stands out that, largely through integration, sudden demands have been met by making available additional supplies, and the story is one of which the Industry can legitimately be proud. Strain on production and distribution has been inevitable during a time of restricted supply of plant, materials, and labour. There has been stability of revenue on the part of the holding companies generally, whatever the fluctuations of the undertakings comprising the groups, and it has been possible to institute improvements in the smaller units, irrespective of the immediate effect on their individual revenue. And through this period, marked by large increases in the cost of coal and other raw materials and in wages, the average price of gas to the consumer, thanks to the greater consumption per consumer due to increased use of gas for industrial purposes, has also been characterized by stability. Some constituent undertakings —exceptions, not the rule—have not found it necessary to make any increases in charges even to domestic consumers. This is not a panegyric of the holding company movement; it is a bald statement of what has happened during the first four years of war. A substantial degree of effective co-operation and joint working has been established, and the possibilities of improved service to the consumer and the more efficient use of our coal resources are apparent.

SUBMERGED COMBUSTION

IT must be nearly fourteen years since our interest was aroused in the submerged gas burner introduced to the Gas Industry here by Mr. Featherstone Hammond, which many technicians thought at the time was an appliance with a future, and which we ourselves thought likely to widen the sphere of usefulness of gas in the industrial field. The basic idea was simple enough, the principle being one-stage rapid and complete combustion of a homogeneous mixture of gas and air in a liquid. The flame was unquenchable, and it was estimated that the effective area of contact of one cubic foot of the gas in solution was about 1.65 acres. A thermal efficiency of something like 95% on the gross calorific value of the gas was quoted, and details were given of the use of the burner for, among other things, the boiling of oil, dyeing operations, and white metal melting. We remember a Paper by Mr. Hammond to the Institute of Fuel in 1930, when those who joined in the discussion were unanimous in their expressions as to the merits of the system. However, little seems to have been heard of it since.

Actually, it was a Paper by Mr. F. E. Lane, Industrial Gas Engineer to the United Kingdom Gas Corporation, given last month to the Manchester Juniors, which made us recall the experiences described in the "JOURNAL" in 1930. Mr. Lane, explaining that submerged combustion is rapidly extending its use in the United States, said that the U.K. Corporation is about to install two sets of submerged combustion equipment in a steel works in our own country. The annual consumption of the units is estimated at 22 million cu.ft., and it accompanies a consumption in immersion burners of about 35 millions. The purpose of the submerged equipment is pickling of steel in sulphuric acid. In this process steel is immersed in a solution of 5–10% sulphuric acid at a temperature of 180–200° F., mechanically agitated to accelerate the treatment. The normal practice is to employ live steam for heating, which obviously results in dilution of the solution and necessitates continuous addition of acid ; there is also the difficulty of drainage. With submerged gas combustion mechanical agitation is unnecessary and there is no dilution of the acid. Savings in acid of from 25 to 50% have been recorded, and in time from 40 to 70%; the operation can be carried out at a lower temperature (160°F.). There is no doubt, said Mr. Lane, that there is a great future for submerged combustion, and gas is the only fuel which can be used on this type of equipment. We shall look forward to hearing of U.K.'s experience with it.

FANCY FREE

WE referred last week to the latest report issued by the Association for Planning and Regional Reconstruction, which, dealing with the thermal efficiency of coal utilization in Great Britain, takes in its stride sun, moon, stars, wind, rain, &c., and epitomizes phenomena such as the opening and closing of the nose when confronted with an electric fire. Taken light-heartedly it makes quite entertaining reading—*e.g.*, "The energy in mechanical and electrical power, light, petrol, and benzole is, of course, liberated quantitatively in the form of heat when the products are utilized. This makes it difficult to decide at what point to study efficiency, for in the limit all the coal energy leaves the earth as radiant heat. The permanent gain to the consumers can only be described qualitatively as years of life rendered possible, or more comfortable, structures set up, materials won from the earth and worked. These are equivalent to increases of organization in opposition to the 'running down of the Universe'." Which, of course, is all very helpful and encourages optimistic belief in the brave new world; and we are overjoyed to read that "the earth's rotational energy provides a reservoir of about 50,000 trillion (10^{18}) horsepower-hours which would, if available, provide heat and power for the whole population, at the present consumption rate of highly industrialized countries, for 300 million years, so that a slowing down of the earth, consequent on its use, is not to be feared." Bravo! And suppose we come to the end of our coal reserves. Well, "direct and efficient use of solar energy could provide for all likely needs, if a few per cent. of the land

areas were given over to suitable plant." Shades of November fogs!

Concerning problems of a more immediate nature, the report embraces carbonization, the Association finding that the efficiency of low temperature carbonization is "very high" though the process is "not very suitable for gas production," and "replacement of domestic coal by semi-coke would entail converting the existing high temperature installations to suit low temperature requirements . . . The capital outlay would be very great." However, "various intermediate processes have been proposed. For example, in the Wright process, which has successfully carbonized 31,000 tons of coal continuously over a year, steam and air are introduced near the middle of a continuous vertical retort, the lower part of which is water-jacketed. Coke is delivered almost cold, and the gas leaves the retort at 150°F. No external heating is required. Oil is an important product. The overall efficiency is said to be 93%. The process gives the same yield of gaseous therms as a high temperature process, together with the characteristic products and high efficiency of a low-temperature process (which yields far fewer gaseous therms)."

Perhaps the layman can without confusion rapidly adjust his mind from thought that, as stated in the report, one pound of matter contains energy of constitution equivalent to 385 million therms to the somewhat smaller conception of the Wright process just quoted. Perhaps the fuel technologist will find the transition rather more difficult, and will assess the value of the report, from the practical aspect, accordingly.

The Paint Industry

Following protests from the smaller manufacturers, the Government last January abandoned a scheme for the concentration of the paint industry, and announced that details of a modified scheme would be worked out by the Board of Trade and the Ministries of Supply and Labour in consultation with the industry. The objection was that concentration would have placed the manufacture of paint in the hands of a few "nucleus" concerns and involved the closing down of over 300 firms, imposing on the small concerns a sacrifice out of proportion to that demanded of the industry as a whole.

The Ministry of Labour, after consultation with the other interested Government Department, has now issued two lists of firms totalling 138 out of over 500 manufacturers, with an accompanying memorandum stating that all firms not included in either list must be prepared to lose their workers who are found suitable for employment either in vital war industries or as substitutes to effect the release of younger and mobile workers. The note adds that the Ministry of Supply will, in future, represent the interests of the using Departments on questions connected with deferment and retention.

The small manufacturers, according to Mr. C. R. Averill, who led the opposition to concentration last November and was mainly responsible for the birth of the Paint Manufacturers and Allied Trades Association at that time, feel that the new move is nothing more or less than concentration under a different name. Unless a firm is one of a limited number "mainly engaged in the manufacture of essential specialities" or an "other firm of special importance to the using Departments" it is threatened with the withdrawal of its labour, starting with the more difficult labour districts. Firms who have complained about being subjected to this danger have been officially advised to seek inclusion in one or other of the lists, but many of them, although turning out important products, have no particular Government Department to "father" them. Some quite small firms are in the lists because they are making something special for a Government Department, but over 350 are left out, and it is reported that some of these have already had to release employees for transfer to rival listed paint makers. In the industry as a whole, over 50% of the people normally employed have been released for war service, and non-essential production has long since ceased.

Members of both the Paint Federation and the Paint Manufacturers and Allied Trades Association have had a mass protest meeting, and a deputation has been to see Mr. McCorquodale, Parliamentary Secretary to the Ministry of Labour, and told him that his Department can hope for little labour from the unlisted firms, and that if it is really necessary still further to deplete the number of workers in the trade the listed firms should be combed. A deputation of Members of Parliament has been received by Sir Andrew Duncan, and the whole matter is now in the hands of Mr. Ernest Bevin, Minister of Labour, whose ruling is eagerly awaited.

Personal

The Dunfermline Town Council has appointed Mr. WILLIAM C. CAMPBELL, Engineer and Manager to the Galashiels Gas Company, to be Gas Engineer and Manager at Dunfermline. The vacancy was created through the appointment of Mr. James Campbell as Regional Gas Officer for Scotland. Mr. William Campbell commenced his career in 1924 at Falkirk, where, in 1929, he was appointed technical assistant, and two years later he obtained the position of distribution superintendent. From there he acted between 1932 and 1935 as assistant gas manager at Helensburgh, and for the succeeding years held office at Buckie. He has acted as Manager of Galashiels Gas Works for the past five years.

Letter to the Editor

Co-Partnership

DEAR SIR,—I cannot accept the statement in the letter from Mr. V. Hewes in your issue of June 30 that "Co-partnership seeks to give rather than to receive." Not even the Gas Industry can afford to be a philanthropic institution, and the cost of a welfare scheme is only justified by the improved results obtained from the labour force. The details of co-partnership as practised in the South Metropolitan and related undertakings are interesting, but what proportion of the co-partnership schemes in the Industry are so advanced, and how many provide for employees' directors? His financial statement means little as it stands. More revealing figures would be (1) percentage represented by co-partnership bonus on average annual earnings, including overtime; (2) proportion of withdrawable bonus cashed; and (3) proportion of withdrawable bonus applied to the purchase of further shares. These figures should be given as an average for an employee below the rank of foreman.

Apparently Mr. Hewes does not appreciate the sense in which I use the word "incentive." Does he suggest, for instance, that a gang of co-partners would discharge a purifier in less time than a gang of casual labourers on a piece-time rate? I should be surprised if his answer to (1) above would bear any comparison as an "incentive to work" with a piece-work rate. Security of employment and provision for old age have a psychological value admittedly, although the former can be at once an advantage and a danger.

Naturally the employee is anxious to sign a service agreement; he may as well have one loaf for the signing as nothing at all. Further, does Mr. Hewes know that there are cases where the rates of pay in an undertaking are lower than those prevailing in the district, and the co-partnership bonus barely makes up the difference? This may be a wartime anomaly, but it merits attention.

Surely if you give an employee a bonus and then tell him he must put so much towards the purchase of shares in the undertaking, the method of saving is compulsory. It is possible to give employees a bonus and *encourage* them to invest as much of it as possible in the company. I am certain that the attempt by co-partnership to bind the employees' fortunes with those of the undertaking does not produce the golden eggs so easily laid in theory in the co-partnership committee rooms.

I did not state that co-partnership schemes subsidize pension funds, although Mr. Cash, in his letter of May 12, appeared to have that in mind. I wished to point out only that an adequate pension scheme could function without a co-partnership scheme in addition. Finally, would Mr. Hewes predict that "brotherhood in business" and the common financial interest in the undertaking of men and management would triumph over the pull of the trade unions in the event of a future general strike? Co-partnership arouses conflicting loyalties for the employee, and it is obvious, if one understands the average worker, which is the stronger.

July 31, 1943.

Yours faithfully,
"FUTURIST."

1943 "Journal" Directory

Page 20.—DARWEN. J. Pollard, *E.&M.*, *vice* T. Haworth.
" 64.—SOUTHMINSTER. Mrs. L. Crawshay, *S.*, *vice* Mrs. L. J. Warnes.
" 80.—YORK. J. L. Steward, *S.*, *vice* H. E. Bloor.
" 86.—INVERNESS. J. Ford, *E.&M.*, *vice* A. Thomson, deceased.

Diary

Aug. 6.—Gas Companies' Protection Association Committee, 5, Victoria Street, S.W. 1, 2.30 p.m.
Aug. 10.—National Federation of Gas Coke Associations: General Committee, Gas Industry House, 10 a.m.
Aug. 10.—National Gas Council, Central Executive Board, Gas Industry House, 2.30 p.m.
Aug. 12.—Industrial Gas Centres Committee, Gas Industry House, 9.30 a.m.
Aug. 16.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m.; Gas Industry House.
Sept. 3.—North British Association of Gas Managers, Annual Meeting, Glasgow.

DISTRICT HEATING

By J. E. DAVIS, South Metropolitan Gas Company

IN recent years there has been some discussion on the desirability of introducing in this country forms of district heating similar to those developed on the Continent of Europe and in the U.S.A. These discussions have caused concern in certain quarters at the possible effect of such systems upon the development of gas supply. In particular it has been suggested that the development of district heating would—

(1) Restrict the market for gas sales, and

(2) If designed to make use of the waste heat from electricity generating stations, so reduce the cost of electricity as to make it difficult for gaseous fuel to compete.

It is, of course, impossible to give an exact analysis of the costs of district heating in comparison with gas and electricity supply except by working out in detail a scheme for a particular locality, but by an examination of published information and a consideration of the general principles involved, certain broad conclusions can be drawn.

There can be no doubt that the centralized combustion of fuel at high efficiency, and the distribution of heat in hot water or steam, form a possible method of removing many of the disadvantages associated with the present practice of burning raw coal in numerous small appliances. To this extent district heating is an alternative to the existing fuel utility services of gas and electricity supply. In comparison with the existing services it shows some advantages and some disadvantages, and a broad comparison may be made on the points given below. (There are two rival systems—distribution as steam and distribution as hot water. Neither system has been able to demonstrate in practice any marked superiority over the other and, therefore, although the following statements are made in respect of a steam system, they are likely, on balance, to apply also to a hot-water system.)

(*a*) The thermal efficiency of steam generation is about the same as the thermal efficiency of coal carbonization.

(*b*) The capital cost of steam-raising plant per therm of steam is about the same as the capital cost of carbonizing plant per therm of gas produced.

(*c*) It follows from (*a*) and (*b*), and it is confirmed in practice, that the cost of producing a therm in steam is approximately equal to the cost of producing a therm of gas.

(*d*) Large scale storage of steam on the production site in impracticable and heavy peak loads on the generating plant are experienced. They may be, and often are reduced by storage on, or adjacent to, consumers' premises.

(*e*) The distribution of heat in steam is much more costly than the distribution of the equivalent amount of heat as gas. This arises from several causes. The heat content of 1 cu.ft. of steam is about one-tenth of the heat content of 1 cu.ft. of gas at the same pressure. Steam mains need effective and expensive thermal insulation. Provision must be made for a return main for the condensate (or returning hot water). Heat losses in distribution are appreciable. For a densely built-up area at times of peak demand they may be less than 10% of the total heat transmitted, but at times of low demands the absolute heat loss remains the same, and the percentage becomes much greater. For a residential district of separate houses, the transmission losses might well amount to 40 or 50%. The initial cost of the distribution system can be kept down by local heat storage, but even when this is applied the initial costs are likely to be not less than double the costs of a system distributing a thermally equivalent quantity of gas.

(*f*) The heat in steam or hot water is at a relatively low potential. The potential is high enough for many purposes such as space heating or hot water supply, and for some types of cooking, but the system would need supplementing by gas or electricity for high temperature operations.

(*g*) For purposes where low potential heat is required the efficiency of utilization is high, though the practical realization of the benefits of this efficiency may be limited by the relative inflexibility of the service.

(*h*) Combustion does not take place on the consumers' premises, and there is, therefore, no need to make provision for the removal of the products of combustion.

(*i*) It is usual to transfer the heat from the steam or the hot water of the district supply to a circulatory hot-water system on the consumers' premises making use of a calorifier. This heat exchange apparatus is not less costly than a boiler of the same heat output. If substantial storage is provided on consumers' premises to ease the peak demands on the distribution system, the equipment may well be much more costly.

(*k*) With coal at 25s. a ton delivered in bulk to the central boiler plant, the cost of steam to a consumer in a densely built-up area is not likely to be less than 4d. a therm; in a residential area the cost is likely to exceed 6d. a therm.

The foregoing comments apply to a district heating scheme standing on its own, and not associated with electricity generation. In connexion with the proposals for combined schemes, the following facts have to be considered:

a. From existing electricity generating stations the heat is rejected at too low a temperature (below 100°F.) to be of any value for a district heating scheme.

b. Increasing the temperature of reject from a generating station would decrease materially the thermal efficiency of electricity generation.

c. Thermally, the correct way of regarding a combined scheme is to consider it as a district heating scheme in which steam is generated at a pressure higher than that necessary for distribution, and expanded to the initial distribution pressure, generating electrical energy as a by-product.

d. By the procedure outlined in (*c*) the thermal efficiency of electricity generation might be increased to about 50%—that is, about double the present figure—but the quantity of electricity available from this source, and the times when it is available, would depend upon the demands for district heating steam. In existing installations the reconciliation of the incidence of demands has proved difficult.

e. By the development of a combined scheme electricity would gain some saving in fuel costs, which form a small proportion of the total cost, and would be able to share the capital cost of steam raising plant with the district heating scheme. On the other hand, electricity would lose the opportunity of selling off-peak current for low potential heat requirements, because these would be met by the district heating scheme. The possibility of improving the electrical load factor is, thereby, greatly reduced, and the average cost of electrical energy might well be increased.

The conclusions derived from the above statements compare well with experience derived from installations in the United States, where climatic conditions would tend to make district heating a more favourable proposition than in this country; yet the following results are observed:

(*a*) That the tendency has been for electricity generation and district heating to be kept as separate undertakings and, indeed, for combined schemes to become separated at a later date.

(*b*) That the American Gas Industry does not regard district heating as a serious hindrance to the development of gas sales for house heating.

The Annual General Meeting of the North British Association of Gas Managers will be held in Glasgow on September 3, when a Paper will be given by Mr. C. Poulson, of West's Gas Improvement Company, and a joint Paper by Mr. W. Nicol Baird and Dr. P. Parrish.

The Gas Light and Coke Company has declared dividends for the half-year ended June 30 as follows: On the 4% Consolidated Preference Stock at the rate of £4%; on the 3¾% Redeemable Preference Stock, 1970, at the rate of £3 15s.%; on the 3½% Maximum Stock at the rate of £3 10s.%, all per annum. The Directors have also decided to pay an interim dividend for the same half-year on the Ordinary Stock at the rate of £3% per annum. All less income tax.

The Wandsworth and District Gas Company has declared a dividend on the 4% Preference Stock at the rate of 2% for the six months ended June 30 last, and on the Consolidated Stock at the rate of 2½% for the six months ended June 30.

The Tottenham and District Gas Company has declared the undermentioned dividends: Ordinary Stock 2½% actual; 5% Preference Stock 2½% actual; 5½% Preference Stock 2¾% actual; all in respect of the half year ended June 30, and all less income tax at 10s. in the £.

The Cambridge University and Town Gas Light Company has declared the following dividends for the half year ended June 30 on the Ordinary Stocks: Consolidated Original Stock, 5%; Consolidated "B" Stock, 3½%; Consolidated "C" Stock, 2½% (same as last year).

A W.R.N.S. Training Depot near London is passing out 30 trained cooks and cooks' assistants every week. All these girls (who are volunteers and must show an aptitude for the job) receive practical training on gas and steam cooking equipment in the galley, supplemented by lectures by a Chief Wren who was a domestic science teacher before the war. Before being passed out each trainee cooks a complete meal without supervision.

The Ministry of Labour and National Service, in conjunction with the Board of Education and the Scottish Education Department, is organizing courses of lectures on Production Planning at various Technical Colleges throughout the country. The establishment of a course in any particular locality will be dependent upon there being sufficient local demand. The lectures will cover the following subjects: Workshop organization and lay-out of plant, operation lay-out, materials, control of quality, motion and time study, final operation lay-out, and workshop economy. The courses will normally be of 20 hours' duration, and will usually be given in evening meetings of two hours each. No fees will be charged for the courses, but no allowances or expenses will be paid by the Ministry.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

THE DESIGN AND SUPPLY OF DOMESTIC GAS APPLIANCES

Institution of Gas Engineers, July 9.

By J. E. WHITE, A.M.I.Mech.E.

Chief of Gas Sales, Newcastle-upon-Tyne and Gateshead Gas Company

Whatever may be the nature of the work of research and development undertaken by the Gas Industry, it must be judged by the resulting benefits, direct or indirect, to the consumer. Improvements in methods of manufacture or distribution may be directly beneficial, in point of price, or may be indirectly beneficial in enabling more satisfactory standards of utilization to be attained. Similarly, improvements in utilization may proceed independently of advances in manufacture or distribution, or may arise as a consequence of such advances, technique being developed to enable their full benefits to be made available.

Selection of Appliances

In the preparation of any policy in respect of the design and supply of domestic gas equipment, first consideration must be given to the requirements of the user, and it is suggested that too much thought cannot be given to this all-important aspect of the problem. The user does not always find it easy to express his wants, he is frequently surrounded by contesting claims, and is subject to the sales propaganda of a variety of interests which may well confuse him, and consequently he tends to look more and more to the industry which supplies him with his fuel to guide him in his selection of appliances. This is at once a responsibility and an opportunity.

A compliment to the Gas Industry is undoubtedly implied in that the average consumer turns almost automatically to it for advice on the purchase of appliances, a compliment which has probably been earned by a steadfast policy which has at all times aimed at supplying appliances which are of proved thermal and operational efficiency, at a price within the means of each class. As over many years the Industry has extended its activities into the field of the hired appliance, and as long-term hire-purchase has become more popular, it automatically became the guardian of the consumer in that the appliances so handled had of necessity to be of a high and progressive order if the reputation of the Industry was to be maintained, and if expenses of maintenance were to be kept down. This, coupled with a growing demand for improved household equipment and healthy competition amongst the appliance manufacturers, has led to a steady "upgrading" of appliances whether designed for hire or direct sale to the consumer.

A Complete Fuel Service

Whether in the post-war large-scale reconstruction of the cities, towns and villages of this country, or in the rebuilding work now under immediate consideration in areas which have been subjected to heavy damage, the Gas Industry has before it an opportunity which is possibly the greatest which is ever likely to come its way—the opportunity of providing a complete fuel service which will be in keeping with the times and the spirit of the people. This opportunity, however, calls for wise and understanding planning, and nothing but good can come from the sincere attempts which are being made to prepare for the problems which lie perhaps not so very far ahead. Such preparation must, however, be wide in outlook and the term "complete fuel service" is intended to convey a policy which, whether by gas or coke, or by gas alone, is complete in the fullest sense of the word. For too long the Industry has been prepared to accept the "occasional" load, and for one reason or another has refrained from striking out into all the branches of a fuel service which it can so adequately fill. Thus, in the provision of suitable appliances for the completion of this programme, a heavy duty falls upon the designers and manufacturers of gas appliances: the duty falls equally, however, upon the Gas Industry, which, if its consumer contact be right, should be the "advance listening post" of these manufacturers.

Complete understanding and mutual confidence between the Industry and the appliance manufacturers thus becomes a matter of first importance, for without it planning efforts will be of little avail. In this direction it is well to note that the time is not far distant when the Gas Industry must be able to say to the National Planning Authority, and the individual Undertaking to its local housing authority and architects: "Our house is in order; we are agreed upon a national and/or regional form of tariff structure; further, in conjunction with the appliance manufacturers who serve our Industry we have maintained active contact with those Government Departments to which post-war planning has been entrusted—the Ministry of Health, the Ministry of Works and Planning, and the Department of Scientific and Industrial Research, with the result that we know your requirements—therefore the complete fuel service which we offer is backed by a range of appliances which are a vast improvement upon pre-war standards, which are laboratory and "district" tested, and for which full-scale production is planned and can be commenced as soon as labour and materials are available."

This highly desirable condition can only come about, however, if the Gas Industry will indicate with united voice what it requires of the appliance manufacturers, and if these manufacturers, working together in common confidence and trust, will take the Industry whole-heartedly into their councils, telling the Industry how far these requirements are practicable. Utopian as this may seem, it is by no means impossible, for the scope of development which is open to all is large enough to absorb the whole productive capacity for many years to come. A fact all too often overlooked is that the normal expansion of the use of gas, as well as replacement required by normal wear and tear, have been at a standstill for nearly four years, and if to this be added the vast requirements of reconstruction and the new developments in the use of gas which are surely forthcoming, it will be seen that there is indeed room for all.

What then are the requirements of the Gas Industry in respect of appliance design and supply? The following remarks are but an attempt to express the outlook and needs of one provincial Undertaking, but it is hoped that the opinions expressed will form the basis of a discussion which will clearly indicate the national trend of thought in such matters.

Operational Efficiency

When discussing appliance design it is all too easy to make use of the term "efficiency" in that limited sense which considers only work done against thermal input. The loose employment of the term has unfortunately been often misleading, and consequently there has been a tendency to reach out towards high thermal efficiency as the only goal whilst overlooking the equally important factor of "operational" efficiency. Obviously it is the desire of the Industry to offer low running costs to its consumers, but these are quickly lost sight of if they are bought at the cost of reliability of operation. Consumers are generally appreciative of the appliance servicing which is freely provided by many Undertakings, but such service rapidly loses its attraction if skilled attention is required once every three or four months to keep the appliance up to concert pitch—it certainly has no charm for the Undertaking which has to foot the bill. In some sections of the Industry "maintenance", or the servicing of appliances, appears to be regarded as either a virtue or a necessary evil; actually this is not the case, as is clearly indicated by the following statement from the Report of the Committee of Enquiry on Gas Quality* set up by the Council of The Institution of Gas Engineers:

> "The necessity for maintenance (including adjustment) of appliances is a nuisance to consumers and a considerable expense to Undertakings. The Committee is convinced that with the supply of gas of unvarying quality, sensibly constant in calorific value, specific gravity and pressure of supply, and free from objectionable impurities, the need for a large proportion of present-day maintenance would automatically disappear, leaving only that part which is necessary to combat fair wear and tear of appliances, together with perhaps the cleaning of burner ports from dust entering them from external sources."

The Committee's recommendations deal with that part of the problem of maintenance as affected by gas quality, but it will be

* *Inst. Gas Eng. Comm. No.* 249 (1942), p. 8.

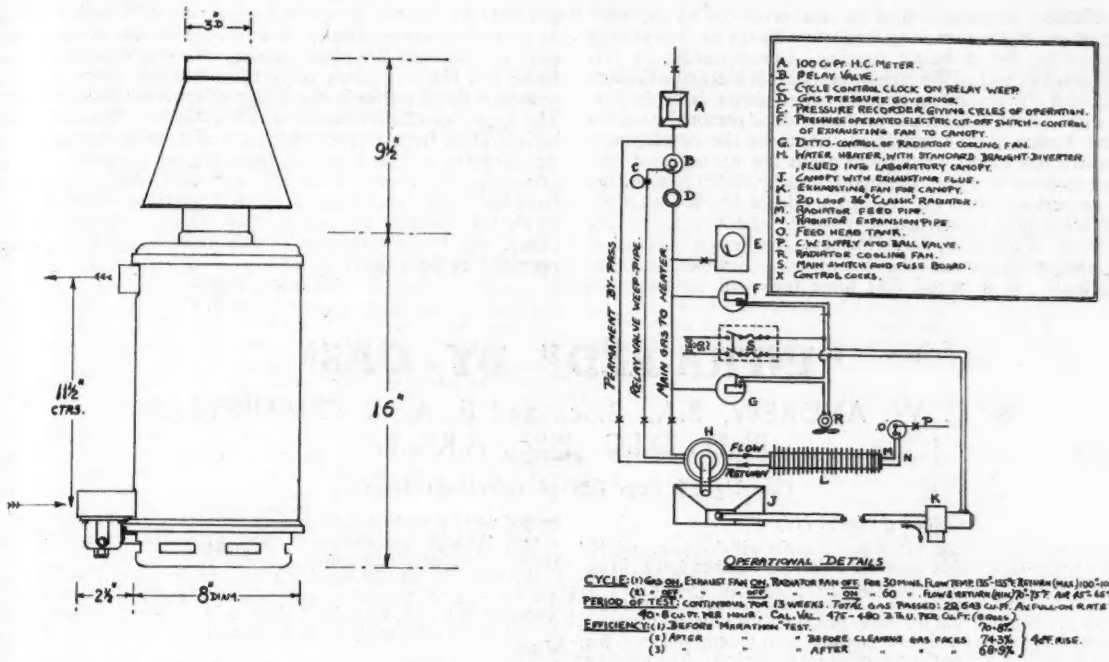

A. 100 Cu. Ft. H.C. Meter.
B. Relay Valve.
C. Cycle Control Clock on Relay Weep.
D. Gas Pressure Governor.
E. Pressure Recorder, giving Cycles of Operation.
F. Pressure-operated Electric Cut-off Switch—Control of Exhausting Fan to Canopy.
G. Ditto—Control of Radiator Cooling Fan.
H. Water Heater, with Standard Draught Diverter, Flued into Laboratory Canopy.
J. Canopy with Exhausting Flue.
K. Exhausting Fan for Canopy.
L. 20 Loop 36" "Classic" Radiator.
M. Radiator Feed Pipe.
N. Radiator Expansion Pipe.
O. Feed Head Tank.
P. C.W. Supply and Ball Valve.
R. Radiator Cooling Fan.
S. Main Switch and Fuse Board.
X. Control Cocks.
3D
9½"
11½" CTRS.
16"
2½"
8" DIAM.
PERMANENT BY-PASS
RELAY VALVE WEEP-PIPE.
MAIN GAS TO HEATER.
FLOW
RETURN
Operational Details
CYCLE: (1) Gas on, Exhaust Fan on, Radiator Fan off, for 30 mins. Flow Temp. (Max.) 100°-105°F.
(2) " off " " off " " on " 60 " . Flow & Return (Min.) 70°-75°F. Air 45°-65°F.
PERIOD OF TEST: Continuous for 13 weeks. Total Gas Passed: 29,643 cu. ft. At Full-on Rate: 40·8 cu. ft. per hour. Cal. Val. 475–480 B.Th.U. per cu. ft. (Gross).
EFFICIENCY: (1) Before "Marathon" Test. 70–8%
(2) After " Before cleaning gas faces 74·3% } 4°F. rise.
(3) " " After " " 68·9%

FIGURE 1.—*Water Heater of Circulator Pattern, with dimensions proportionate to duty to be performed.*

agreed that some of the causes of frequent maintenance attention are due to errors in the design of the apparatus. For many years there has been a slogan in the Industry with regard to the final exit of sulphur; it is of vital importance that the same dismissal be given to appliance maintenance, which is by no means impossible if care in design be coupled with the Committee's recommendations.

Water Heaters

Happily the need for maintenance does not apply in an equal degree to all gas appliances, but in water heating, for example, where for some reason or another the fallacy that gas is dear still persists, there is room for much improvement. The appliance manufacturers, straining after the desires of the Industry in respect of high thermal efficiency and completely automatic operation, and at the same time providing themselves with good advertising material, have arrived at a stage where their products are referred to as "machines". Many are indeed truly machines in their complexity of design, and not a few are machines which, by their design, are called upon to operate at a degree of thermal loading such as would not be contemplated for any other form of simple heat exchanger.

It is quite unnecessary that the present complexity of design and overload should persist—the Lancashire boiler has retained all its rigid simplicity of design, yet in a review† covering the average working of 250 typical boiler plants there is evidence of an average net working efficiency of 60 per cent even though the installations covered a range of from 750 to 70,000 tons of coal per annum and working pressures of from 12 to 200 lb. per sq. in. It is therefore suggested that as the character of town gas is conducive to high thermal efficiency, the first requirement of a gas water-heater is simple, rugged construction coupled with dimensions which are proportionate to the duty to be performed.

In Figure 1 will be found the overall dimensions of a water heater of the circulator pattern, which is the result of an attempt to fulfil this specification in that whilst it is lightly loaded in its normal form, when operating at 15,000 B.Th.U. per hr, it is capable of immediate stepping-up to 20,000 B.Th.U. per hr. by the simple exchange of the burner jets should any change in circumstances necessitate a greater supply of hot water; thus in one heater of dimensions acceptable to post-war designs is found a variable capacity capable of meeting the requirements of the average 5- to 7-roomed house, whether the family be large or small. In service on the 15,000 B.Th.U. rating, the heater has shown itself capable of working over prolonged periods under arduous conditions which have led to the failure of the more complicated types; yet with a minimum of maintenance the initial efficiency has been well maintained. In the stepped-up version of 20,000 B.Th.U. per hr. the heater has been subject to a recent "marathon" test, the arrangements of which are also illustrated in Figure 1, the object of this test being to establish the effect of the higher rating from the maintenance and thermal efficiency angles. In the course of operation for three months the equivalent of the normal consumption for nine months (30,000 cu. ft.) was passed, the heater receiving no maintenance whatever, and upon stripping it was evident that a further 3 or 4 months of service could have been undertaken without risk of a falling-off in operational efficiency, as indicated in the tabulated results in Figure 1, or any serious effect upon its combustion characteristics. Evidence of work of this nature is the principal concern of the Utilization Sub-Committee of the British Gas Federation's Post-War Planning Committee. This sub-committee, which is charged to "study the general question of service to the consumer to the end of enabling the public to use gas and coke more abundantly and thus to reduce the selling price of these commodities", is highly representative of all parties interested in the design and use of gas appliances and consequently is well equipped to investigate the mass of evidence available. Through this investigation, which is by no means easy by reason of the many issues which are involved, the errors of the past are being corrected and the requirements of the reconstruction period, whether in the form of new houses, the building of blocks of flats, or the modernization of existing property, are being soundly prepared.

Space Heating

Probably the greatest potential development in the use of gas for domestic purposes lies in the continuous space-heating load and the Industry will miss a great opportunity if it does not make fully known the developments which are afoot in this direction. Reference has already been made to the provision of a fuel service in keeping with the times and the spirit of the people. Both of these quite rightly demand that the fuel arrangements of the future shall provide a service which, whilst reasonable in cost, eliminates the troubles, nuisances and labour which have been the characteristics of the unprocessed-fuel era: there is also justifiable expectation that the public trend towards the use of smokeless fuels, which was clearly apparent before the war, will be energetically followed up as a matter of national fuel policy for reasons of national economy and public health. What better charter could the Gas Industry require for the development of the space-heating load?

† *Kemp's Engineer's Year Book*, 1935, 41st Edition, p. 1023

The efficiency of utilization of the heat produced by the combustion of gas in gas fires is an important factor in determining their adoption for domestic heating. Consequently, in this field the development of the highest practicable thermal efficiency coupled with corresponding operational efficiency is of the first importance. In this direction, as the result of personal observation, the Author pays unqualified tribute to the development work which has recently produced a gas fire having such outstanding features as a high thermal efficiency which is sustained over long periods of service, complete silence at maximum gas rate, a seemingly indestructible radiant, and which, by the introduction of luminous flame burners, has in one courageous stroke almost eliminated the maintenance problems of the heating load. It is hoped that these fires will be developed not only in size but in detailed construction in such a manner as to ensure automatically their incorporation as an integral part in post-war fire-place design. As almost every human being has his own ideas of comfort heating, there is endless scope for development in the design of space-heating appliances. The appliance manufacturers are fully alive to the potentialities, as is evident from reports which are circulating concerning the development of gas fires incorporating an increased measure of convection heating (in a manner which will overcome the troubles which have been associated with this method in the past), yet retaining the radiant heat which is so acceptable to many, and the introduction of automatic temperature control operated by both factors.

(*To be continued*)

"INFRA-RED" BY GAS*

By L. W. ANDREW, B.A., B.Sc., and E. A. C. CHAMBERLAIN, Ph.D., D.I.C., B.Sc., A.R.C.S.

(Gas Light & Coke Company, Watson House).

(*Continued from p. 115*)

As the object heats up the rate of heat transfer will decrease, and the last column shows the effect when the object has reached 220°F. This fall is insignificant when the source temperature is above 600°F.

The most suitable flux density is determined primarily by the rate of heating up required, and for many processes the ultimate temperature reached by the object is unimportant, as it is removed from the source of heat long before this temperature is reached. The ultimate temperature cannot exceed the temperature of the surrounding sources, and normally the object will be at a substantially lower temperature due to convected heat losses.

The table suggests that for normal work an adequate reserve of heating is obtained by the use of sources at about 600°F., substantially surrounding the object to be heated, and for work at a really high rate of heat transfer surfaces at about 1,500°F. would be suitable. This method is the one most easily applicable to the Gas Industry. The electrical industry finds it more convenient to use very small sources at high temperature, to space them apart and then direct the radiation by reflectors on to the object to be heated.

Distribution of Radiation.—For most purposes it is desirable to have as uniform a radiant intensity as possible on all exposed surfaces of the object to be heated.

The maximum economy of space would be obtained if the object were surrounded by surfaces following its own contour and placed close to it. From a practical point of view a reasonable clearance is needed between the source and the object in order to widen the scope of any one unit to deal with objects of different size and shape.

Simple shapes of unit will normally be satisfactory—for example, vertical walls or parts of a spherical shell.

If sources of large area are used, each application must still be considered on its own merits, and the size and shape of the unit should be as simple as possible—*e.g.*, sheets of metal can readily be heated between vertical walls, whereas a curved shape is generally desirable if the object to be heated has a depth of the same order as its width and height.

With metal objects the high conductivity is sufficient to even up minor temperature gradients, and little difficulty occurs so long as the radiating surfaces are reasonably even in temperature. The problem of design is more critical if objects of a low conductivity material, such as wood, are to be heated on the surface.

The electric type of unit with large numbers of lamps at the focus of parabolic reflectors needs very careful arrangement and adjustment of overlapping beams in order to obtain uniformity of heating, and considerable stress is laid on the importance of getting the right configuration of unit for a particular job.(5)

For gas sources, practical experience has shown that a unit with large radiating surfaces of two semicircular sections facing each other, having a radius of 16 in., gave excellent results on thin metal sheets 2 ft. square, on metal cans 2 ft. high, 1 ft. 6 in. wide, and 6 in. deep, and on heavy tapered castings of cylindrical shape 1 ft. in length and a maximum diameter of 4 in.

For certain types of work where the objects may be irregular in shape and thickness and there is little margin between the drying temperature and the spoiling temperature of the paint, it may be desirable to take advantage of a variation in radiation intensity over different parts of the object, or it may be necessary to produce a high overall radiant intensity for heating up, and a lower radiant intensity to maintain a temperature obtained quickly by the high intensity.

The electric type of unit can readily obtain local variations in intensity by adjustment of reflectors and spacing of the small units, but it is a matter of adjustment by a skilled person to obtain such results. A less drastic change in intensity can be obtained on a gas-heated unit by modifying the surface temperature of the unit either in a vertical plane or a horizontal plane as required—an easy matter in the initial design of the unit.

It is also easy on a gas-fired unit to lower the gas rate and hence the average surface temperature and radiant intensity of a whole unit or a section of a unit, while local changes in emissivity can be achieved by painting the normally black surface with heat-resisting aluminium paint.

Absorption of Radiation.—The absorption of radiation by a surface depends on the emission spectra of the radiation and the characteristics of the surface; if the surface is painted then the absorption characteristics of the paint—*i.e.*, the vehicle and the pigment—generally play the most important part in determining the degree of absorption obtained.

All the practical sources of infra-red suggested at the moment have a continuous type of spectrum, although the energy emitted will reach a peak at a wave-length depending on the temperature of the source—the higher the source temperature the shorter the wave-length at which this peak will occur.

Maxted discusses the effect of wave-length on absorption by different pigments and different vehicles in considerable detail.(6)

Paints differ so much in composition that it is unwise to make general statements on the difference between the degree of absorption of infra-red rays from sources at 600°F., 1,600°F., or the tungsten filament lamp at 4,000°F., although it would be expected that pigments of different colours would show a smaller variation in absorption when the lower temperature sources are used. As an example of this, the following Table II compares the time of heating up of identical sheet metal plates using a white, blue and a black heat-transformable paint subjected to sources at 650°F. and 4,000°F., all giving the same flux density. Table III compares the time for a painted steel plate, s.w.g. 18, to reach 300°F. for similar paints from the same manufacturer, but of different colours.

TABLE II.

Gas medium temperature tunnel and electric tungsten lamp tunnel, comparison of the time of heating up of the same metal plates (18 s.w.g.) white, blue, and black, both panels adjusted to give the same flux density.

Time (seconds) for plate to reach 300°F.

	Gas tunnel.		Electric tunnel.
White	175	.	270
Blue	165	.	180
Black	150	.	150

Gas-Operated Infra-Red Units

It is an easy matter to obtain direct gas-heated radiating sources of any reasonable shape operating at temperatures up to 2,000°F., and the choice will depend on the nature of the particular problem. Experience with two types of unit will be quoted :

(1) A medium temperature unit giving a large surface area at about 650°F.

TABLE III.

Gas medium temperature tunnel at 685°F. Time for different coloured panels of 18 s.w.g. to reach 300°F. (seconds).

Glossy	Black	67		Matt	Black	60
,,	White	71		,,	White	63
,,	Yellow	75		,,	Blue	66
,,	Red	75		,,	Green	67
,,	Green	75		,,	Red	70
,,	Blue	77		,,	Yellow	74

* From a Paper to the Institute of Fuel, July 21.

(2) A high temperature unit giving a smaller area at about 1,600°F.

A description of the units, and the results of tests using them, show what is being done and what can be done by gas.

The Medium Temperature Unit

Principle.—The radiating source is a blackened steel sheet at an average temperature of about 650°F. The radiating source almost surrounds the object to be heated, leaving space only for the conveyor equipment necessary to pass articles through the unit.

Construction.—One type of unit consists essentially of two similar half sections facing each other. Each section consists of a front steel sheet about 5 ft. long by 3 ft. wide, curved to form the greater part of a semicircle of 16 in. radius. Behind the sheet is an insulating refractory back giving a tapered space between sheet and refractory of 3¼ in. at the bottom to ¼ in. at the top. A bar burner with standard luminous jets is at the base, and products of combustion pass up the tapered space and are further restricted at the top to give a CO_2 content of about 8%. In order to obtain uniform heating of the sheet it is advisable to protect the bottom quarter of the inside of the sheet by an inner sheet giving a sealed air space of about ¼ in., and to rib the top quarter of the front face of the refractory back or the inside of the sheet with ribs $\frac{3}{16}$ in. deep, and spaced 1¼ in. apart, in order to increase heat transfer at the top.

In operation the units are placed facing each other, and any length of tunnel can be formed by placing a number of units side by side.

Performance.—The figures given were obtained on a single pair of units only 3 ft. wide, and would be improved for longer lengths of tunnel, in which end losses would be much smaller, although, as far as possible, end losses were reduced by using reflecting sheets of aluminium foil. The gas rate per foot run will be substantially reduced for a longer tunnel.

Heat Balance.—This is approximately as follows:

Forward useful radiant heat	50%
Convected heat from front panel	15%
Heat in flue gases (Flue temperature 680°F. average) (CO_2 = 8% average)	25%
Heat loss from back and structure	10%

Gas rate = 220 cu.ft. per hour per 3 ft. run of double panel.

Air Temperature between Panels during Operation.—During actual paint-drying tests the air temperature as measured by suction pyrometer was 25°F. above the outside air.

Practical Tests on Heating of Sheet Metal Objects and a Heavy Casting.—The following results are typical:

Heating of sheet metal plates 12 in. by 5 in. s.w.g. 6, and 12 in. by 12 in. s.w.g. 22:

Time.	S.w.g. 22. 70°F.	S.w.g. 6. 70°F.
0 sec.		
10 ,,	140	—
15 ,,	175	85
30 ,,	240	100
45 ,,	300	114
60 ,,	335	130
1½ min.	390	160
2 ,,	410	195
2½ ,,	425	225
3 ,,	430	250
4 ,,	—	290
6 ,,	—	344
8 ,,	—	390
10 ,,	—	417

Heating of a shaped casting 15 lb. in weight with a surface area 0.9 sq. ft.

Time.	External temp. 70°F.
0 min.	
5 ,,	160
10 ,,	210
15 ,,	260
20 ,,	295
30 ,,	355

Practical Paint-drying Tests.—Three samples will be quoted:

(1) High grade white heat-transformable refrigerator paint on a steel plate 1 ft. by 1 ft. of s.w.g. 22—undercoat and finishing coat.

(2) Buff heat-transformable paint on a 19 s.w.g. steel petrol can with handles and filling cap—overall size 18½ in. high by 13¾ in. wide by 6 in. deep.

(3) Varnish on a 15-lb. cylindrical casting with tapered top—overall length 12 in. maximum, diameter 4 in., wall thickness ½ in.; the casting was open at the bottom and closed at the top.

(1) White heat-transformable paint on s.w.g. 22 sheet steel:

The priming coat was properly dried after 3 min. in the unit. The finish was overstoved in 5 min.

The finishing coat was properly dried in 1¾ min. In 2¼ min. there were signs of slight deterioration in the high gloss of the finish.

In a direct-fired convector oven a temperature of 590°F. was needed to dry the primer in 3 min., and the finishing coat in 1¾ min. when the plate was exposed to the walls of the oven. When the plate was protected from wall radiation by polished aluminium plates the corresponding temperatures were 720°F. for the primer, and 700°F. for the finishing coat.

A convector oven at 350°F. with the plates shielded from radiation took 30 min. to dry the primer and 16 min. to dry the finishing coat.

(2) Buff heat transformable paint on a 19 s.w.g. petrol can:

The panels were at an average temperature of 650°F.

The paint was satisfactorily cured in 5 min. with the can hung upside down, and there was no softness at re-entrants by the filling cup or shadowed parts of the handles. There were signs of spoiling of the paint after 6 min.

In a direct gas-fired convector oven the air temperature needed to dry the paint in 4 min. was 590°F. with the can exposed to the wall, or 710°F. with the can protected from radiation.

In a direct-fired oven at 350°F., with the can shielded from radiation, it took 30 min. to dry the paint.

(3) Protective oxidizing type varnish on a 15-lb. casting:

With the panels at an average temperature of 650°F. the varnish was cured in 45 min., and was spoiled by scorching in 50 min.—the varnish not being destroyed but too dark in colour for the particular purpose required.

A convector oven at 350°F. took 120 min. to cure the varnish.

The High Temperature Gas-Fired Infra-Red Unit

This is similar to the medium temperature unit, but has a much higher flux density and gives some radiation in the visible part of the spectrum.

One such unit is the surface combustor in which an air gas mixture is burnt flamelessly on the surface of a porous refractory panel. It gives a brilliantly incandescent evenly hot surface, and can be made in any suitable size or shape and gives flux densities up to 40,000 B.Th.U. per sq. ft. per hr. if the object is completely surrounded by the combustion surface.

Experience has been gained on an alternative type of panel unit giving a maximum flux density of 25,000 B.Th.U. per sq. ft. per hr.

This type of panel has proved useful for preheating heavy castings, Monolizing, and also for heating liquids flowing through glass tubes.

The 15-lb. casting previously mentioned was raised from 70°F. to 350°F. in 4 min. as compared with 30 min. using the medium temperature panel—this result was obtained using only a single pair of panels, which resulted in abnormally heavy end losses.

The Electric Infra-Red Unit.—The electrical industry in this country has standardized on a special tungsten filament lamp, and uses parabolic reflectors to direct the radiation on to the object to be heated. Maxted described these units in some detail.(*)

In order to get the necessary flux density a tunnel or trough lined with parabolic reflectors is normally used. The distances apart of the bulbs, the angle, spacing and distance of the reflectors must be very carefully worked out even to get a uniform intensity on a central plane.

With clean reflectors, radiant heat emission from the unit is claimed as about 80% efficient.

Such tunnel units are potentially very flexible and easily adapted to existing conveyor systems, but in practice considerable skill is needed to determine and obtain the particular configuration of reflectors required, while the need for heavy switchgear and ventilating hoods to remove solvent vapours means that in practice the tendency is to make a permanent fitting of the configuration and position of any installation. Flexible leads do, however, enable the panels to be moved sufficiently to give proper access for maintenance.

The maximum flux density claimed is 10 watts per sq. in. on the working plane—*i.e.*, 5 watts per sq. in. on each side of panel at the centre of the unit—and the normal flux density used in practice is 2 to 3 watts per sq. in.

Some Merits of the Gas Units.—When considering the installation of infra-red units the following points should be borne in mind:

(1) There are no reflectors to keep clean.

(2) The general construction is very robust and simple, giving a long life and freedom from maintenance troubles.

(3) It is easy to obtain an even distribution of radiation.

(4) It is easy to construct the units in different sizes and shapes.

(5) The range of flux density is very much greater, and if desired can be 10 times the present of electric.

(6) It is easy to reduce the flux density steadily by turning down the gas.

(7) The emission spectrum is such that the effect of paint colour is generally less marked than for the electric system.

(8) The capital cost is much less.

(9) In running cost—gas at 9d. a therm compares with electricity at ½d. a unit.

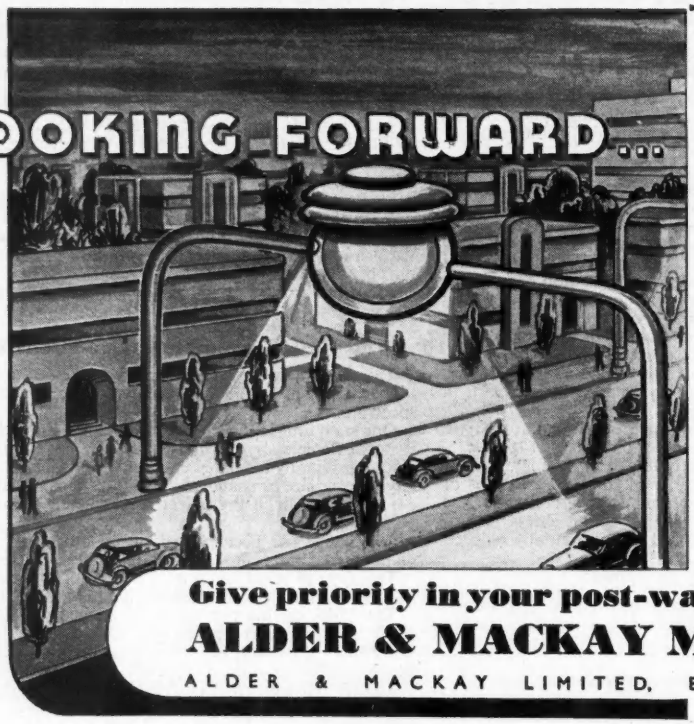
(10) The space occupied will normally be less.

(11) No heavy and elaborate switchgear is needed.

Conclusions

There are many industrial processes for which radiant heating or infra-red offers a substantial advantage over convectional heating methods. The fact that radiant heating and infra-red heating are identical and that industrial gas appliances have made considerable use of radiant heating should enable the engineer to appreciate the uses of infra-red.

The Gas Industry has available methods of providing radiant



How is the Gas Industry going to tackle the problem of post-war street lighting? Will it hold and improve its place in this field of public service? We offer a tentative suggestion . . . Have you any others to make to us? As street lighting specialists we are vitally interested in upholding our progressive reputation.

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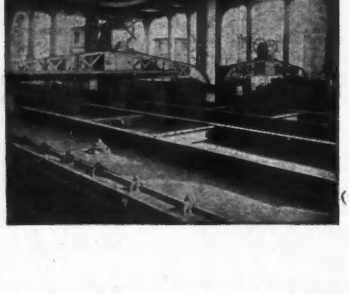

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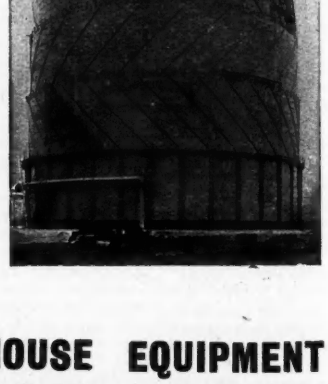

GASHOLDERS

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483

heating which, because of their advantages in range of intensity, simplicity, ease of application, maintenance, capital, and operating cost, offer opportunities for extensive development in industrial heating processes.

It is important, however, to use infra-red heating for its proper purpose, and not to attempt to use it where convection heating would be preferable. In order to achieve this object the principles of radiant heating must be clearly understood.

Generally speaking, radiant heating offers a simple way of getting a high rate of heat transfer to an object which requires heating. It is therefore possible to obtain a very rapid heating up of the object, and often the object is removed from an intense zone of radiation long before the ultimate temperature is attained, and then allowed to cool, or transferred to a less intense zone.

Any process which can be carried out in a short time at a high temperature instead of in a long time at a low temperature is particularly suited to the application of infra-red rays. It is important that there should be the minimum "shadowing" from the radiant heat on any part of the object to be heated, and also that objects given the same treatment should be of reasonably similar weight, surface area ratio, and reasonably symmetrical in shape and uniform in thickness. It is a matter of trial to find out to what extent conductivity of the material will smooth out temperature gradients due to variations in local shape and thickness.

Practical experience shows that radiant heating can be applied successfully to many conveyor ovens used for paint and other drying processes, but is normally unsuited to the batch type of oven. It has also become clear that the possibility of increasing the normal temperature of convector ovens should be considered as a method of speeding up the drying of paint—care must be taken, however, to avoid spoiling of articles unshielded from the walls of the oven.

Finally it should be remembered that the choice of the best type paint may be of fundamental importance in dealing with a paint-drying problem, and here the paint manufacturer can be of the greatest help.

References

(1) McAdams.—*Heat Transmission*, 1933, chap. vi. McGraw Hill. Fishenden and Saunders, *The Calculation of Heat Transmission*, 1932, chap. vi. H.M.S.O.
(2) McAdams.—*Loc. cit.*, chap. iii. Fishenden and Saunders, *loc. cit.*, chap. i.
(3) Maxted.—*Trans. Inst. Illuminating Eng. Soc.*, 7, No. 1, p. 7, 1942.
(4) *Idem.*—*Loc. cit.*, p. 11.
(5) *Idem.*—*Loc. cit.*, p. 9.
(6) *Idem.*—*Loc. cit.*, pp. 10–13.
(7) Fishenden and Saunders.—*Loc. cit.*, p. 141.
(8) McAdams.—*Loc. cit.*, p. 50.
(9) McAdams.—*Loc. cit.*, pp. 145–146.

GAS CONSOLIDATION, LTD.

The Ninth Annual General Meeting of Gas Consolidation, Ltd., was held on July 28 at 15, Moorgate, London, E.C.

Major Julian Day (the Chairman) presided.

The Secretary (Mr. C. B. Mawer) having read the notice convening the meeting and the report of the auditors,

The Chairman said: The accounts, compared with the preceding year, show few changes. As shown in the Directors' report, after providing for dividends at the rate of 5% per annum on the A and B Ordinary shares—the same rates as those paid last year—the sum carried forward is slightly increased. Mr. R. S. Snelling has been appointed General Manager and Mr. C. B. Mawer Secretary. These appointments follow on similar appointments to the staff of Severn Valley Gas Corporation. As I have previously explained, the same operating staff functions for both companies, which therefore may be regarded as a single operating unit.

In the consideration of post-war plans a large measure of agreement has been attained in favour of a policy leading throughout the Industry to a greater degree of integration, which has been defined as meaning association between undertakings conducive to efficiency, economy, and progress. This definition expresses precisely the declared aims and objects of this company and of its close associate, Severn Valley Gas Corporation, which are among the first of the so-called holding companies to have been formed.

To accomplish their declared objects these associated companies proceeded to bring a number of gas undertakings together into one integrated group by means of purchase of at least a majority share interest, with the approval of the Directors of each company concerned. It was, therefore, an entirely voluntary method involving negotiations leading to agreement as to the price to be offered to the shareholders, and to other conditions of the acquisition, and then became subject to acceptance on the part of a sufficient proportion of shareholders.

Such a method necessarily has both imperfections and limitations. Opposition may arise through lack of understanding, or through personal considerations, or because of criticisms which may or may not be justified. Geographical unity may be frustrated by the refusal of one centrally located undertaking to agree an economic price, or perhaps to consider any proposal. Nevertheless, by this general method integration has been effected more extensively and more rapidly than by any other method yet adopted.

In areas where there has been general adhesion to a group thus formed, the benefits derived can be demonstrated to have been considerable. Even in instances where the group lacks geographical unity, benefit has resulted, though in less degree. The two related groups to which I refer extend from the Manchester area in the north to the south of Gloucestershire and Monmouthshire. In parts of this area the bulk of the gas undertakings are included, but there are gaps. Geographical cohesion, however, has been a very definite object, even when it necessitated the inclusion of small uneconomic undertakings.

It has been possible to obtain supplies of coke-oven gas in only two sections of this area—namely, in the northern section, from two separate coke-oven installations and in Monmouthshire. Where available, this source of supply has been utilized to the maximum degree. Elsewhere the policy has been to link together by connecting mains adjoining undertakings to the greatest extent compatible with the cost involved. This has not always been possible during war conditions, but in Gloucestershire important progress in this respect has been made.

A few statistics will indicate the progress of the combined groups. Sales of gas in the aggregate for the calendar year 1939 amounted to 4,389 million cu.ft. For the year 1942 aggregate sales for the same undertakings amounted to 6,730 million cu.ft., an increase of 53.3%. If the calculation had been made in therms the result would be closely similar.

An average increase of this magnitude indicates a much greater increase on the part of some of the constituent companies, and it can be readily realized that a considerable strain on production and distribution was inevitable at a time when conditions restricted the supply of plant, materials, and labour. This increase in consumption was not sought, for use of any form of fuel except for essential purposes is restricted. My point is that in response to the sudden demand the additional supplies were made available.

The average price of all gas sold by the 41 undertakings comprising the two groups at the date of acquisition was 10.04d. per therm. The average price realized for the year 1939 was 9.6d. per therm, indicating that our policy aimed at effecting reduction of price. Since the date of acquisition, the cost of coal purchased by the constituent companies has increased by over 50% and the large increase in wages which has taken place is well known. Nevertheless, the average price realized for the year 1942, similarly calculated, was 9.89d. per therm, actually lower than at the date of acquisition and only very slightly above the pre-war period. Several of the constituent companies have not found it necessary to make any increase in charges even to domestic consumers, but this is exceptional.

The steadiness of the average price has been made possible by the greater consumption per consumer due to increased use of gas for industrial purposes. Doubtless the Gas Industry could furnish similar statistics in other areas where somewhat similar conditions have prevailed, but few, if any, other industries can show such steadiness in the average sale price of their primary product throughout the war period. These figures cannot be taken to indicate uniformity in price throughout the area, which is quite impossible to attain by any group of undertakings operating under separate enactments.

Since the date of acquisition of the constituent undertakings, expenditure of a capital nature on the part of companies of both groups to the end of December last had amounted to more than £1,150,000, but only approximately half of this amount has been provided by new capital issues.

I have given these statistics to indicate the growth and progress which it has been possible to achieve under private enterprise and by means of a method of integration by entirely voluntary action, and within all the restrictions pertaining to statutory control of the several undertakings. If such integration can be stimulated without stifling enterprise and without hampering sound and progressive management it would appear definitely to be in the national interest.

On the financial side there has been great stability of revenue on the part of the two parent companies, however great the fluctuations in this respect of the companies comprising the two groups. Fluctuations in the smaller units of a group become unimportant, and for that reason it is possible to institute improvements irrespective of the immediate effect on their revenue. As separate entities such progress is severely restricted.

I think that it will be generally admitted that, in the past, the primary object of legislation affecting the Gas Industry has been to prevent the abuse of power inherent in the exclusive right of supplying gas which each undertaking exercises within its own area. Some legislation enacted many years ago with the object of preventing abuse has in recent years acted as a definite check to enlightened progress. Now, however, that for the first time a single Ministry exercises control over coal, gas, and electricity, there would appear to be solid grounds of hope that the legislation of the future in correlating the activities of these industries will aim to encourage the efficiency of each in the national welfare.

There is nothing in the past to indicate that in the case of the Gas Industry national ownership or a greater degree of public ownership would be conducive to a higher degree of efficiency than is being attained under private enterprise, but there can be no doubt that powers of control, wisely exercised, may prove of benefit to the efficient and economical growth of the Industry, thus enabling it to render both to industrial and domestic consumers a constantly improving and expanding service.

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Gas Products Prices

The London Market Aug. 2.

All Coal Tar Products are in good demand, and Pitch in the London area remains about 45s.

A new Order entitled The Control of Toluene (No. 3) Order, 1943 (S. R. & O. 1943, No. 976), came into force on July 20, and introduces certain changes in the prices for different grades of Toluene.

Apart from this there are no changes to report in Tar Products prices.

The Provinces Aug. 2.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 1s. 10d., pure, 2s. 5d. (controlled by the Control of Toluene No. 2 Order, July 3, 1941, which fixes the maximum price at which this material may be sold). Naphtha and Xylole controlled by the Coal Tar Naphtha and Xylole Order, 1943, dated May 31 (S. R. & O., 1943, No. 768), operative from June 1. Carbolic acid, 60's, naphthalene, and anthracene controlled by the Coal Tar Products Prices Order S. R. & O. 2509, dated Dec. 7, 1942, and operative from Jan. 1, 1943. Filtered heavy oil (min. gr. 1,080), 7¼d. to 8d. Creosote oil has been generally controlled as to direction and price for some time past. Current value—fuel grades 5d. to 5½d.; timber preservation and other purposes 4¾d. to 6d.

* In regard to pitch and crude tar prices we woulp ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Tar Products in Scotland July 31.

Deliveries have resumed on a substantial scale. Refined tar controlled. Value is 4¼d. per gallon *ex* Works, naked. Creosote oil: Specification oil, 6½d. to 7d.; low gravity, 7¼d. to 7½d.; neutral oil, 6d. to 6½d.; hydrogenation oil, 5⅞d. per gallon; all *ex* Works in bulk. Refined cresylic acid is in good call at 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha 6½d. to 7d. per gallon. Solvent naphtha: Basic prices delivered in bulk, 90/180 grade 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.; Rectified, 2s. 3d. per gallon. Pyridine: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

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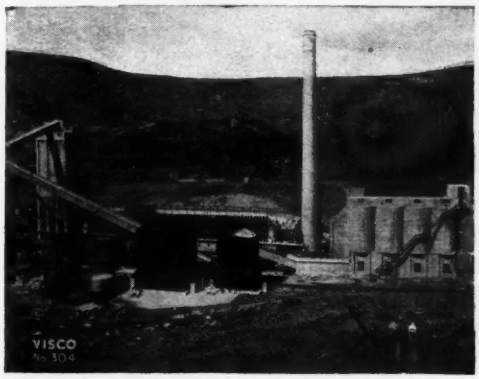

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GAS STOCKS AND SHARES

The news of Mussolini's resignation gave a fillip to Stock Exchange affairs at the outset last week, the number of markings on Monday being the heaviest for over two months. The volume of business eased off towards the close, although the industrial sections remained cheerful and a good demand developed for oil shares.

The Gas Market was comparatively quiet in view of the increased activity in the more speculative sections and there were no special features. Prices, however, remained firm, and the few changes last week were in an upward direction. During the month of July the number of movements in quotations was the lowest for many months past, but, apart from a few *ex div.* markings, there were no falls. The best feature was the gain of 12 points in Bournemouth 7% maximum stock, while Alliance and Dublin and Weston-super-Mare ordinary stocks both closed 7 points up on the month.

There is still a good selective list of debenture stocks on offer with yields ranging from £3 7s. 6d.% to a little over 4%. A parcel of £4,000 Commercial ordinary at 71 may be of interest.

The following price changes took place during the week:

OFFICIAL LIST			
Brighton Cons.	85—90		+1
Gas Consolidation Ord. "B" (x.d.)	17/6—19/6		July 26
Gas Light 4 p.c. Pref.	92—95		+1
Ditto 3½ p.c. Red. Pref.	94—97		+1
Imperial Continental	88—91		+1
Ditto 3½ p.c. Red. Deb. (x.d.) ...	95—100		July 26
South-Eastern Gas Corporation Ord.	19/9—20/9		+-/3d.
Ditto 4½ p.c. Red. Cum. Pref. ...	19/9—20/9		+-/3d.
South Suburban Ord.	97—102		+2
SUPPLEMENTARY LIST			
Cambridge 7 p.c. Cons. "B" (x.d.)	135—140		July 26
Gas Consolidation "A" Ord. (x.d.)	16/6—18/6		"
PROVINCIAL EXCHANGES			
Bristol 5 p.c. max. (x.d.)	112½—114½		July 19
Hartlepool	84—86		+1
Newcastle Units	23/6—24/-		+-/3d.

Quotations on the London and Provincial Stock Exchanges

OFFICIAL LIST

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations July 30
1,767,439	Sept. 7	5	5	Alliance & Dublin Ord. ...	90—100
374 000	June 28	4	4	Do. 4 p.c. Deb.	95—100
583,407	May 10	5	5	Asscd. Gas & Water U'd'ts Ord.	19/6—20/6
388,938	"	—	—	Do. Deferred	19/6—20/6
500,000	"	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/3—20/3
535,545	"	4	4	Do. 4 p.c. Red. Cum Pref.	19/6—20/6
341,966	"	4	4	Do. 4 p.c. Irred. Cum. Pref.	17/6—18/6
561,370	Feb " 22	7	7	Barnet Ord. 7 p.c.	155—160
300,000	June 15	1/4⅛	1/9⅛	Bombay, Ltd.	22/6—24/6
690,407	Feb. 15	7	7	Bournemouth 7 p.c. max. ...	150—155
362,025	June 15	4	4	Do. 4 p.c. Deb. ...	105—110
659,955	March 15	2½	2½	Brighton, &c., 5 p.c. Con. ...	85—90
855,000	"	6	6	Brit. Gas Light Ord.	107—112
545,000	June 28	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115
120,000	" 15	4	4	Do. 4 p.c. Red. Deb.	92—97
10,000	Nov. 6 '33	6	4	Cape Town, Ltd., 4½ p.c. Cu. Pf.	45/——65/-
626,860	July 19	6	6	Cardiff Con. Ord.	110—115
24,500	June 15	7	7	Colombo 7 p.c. Pref.	21/6—23/6
764,169	March 22	-/9.56	-/9.56	Colonial Gas Assn. Ltd. Ord. ..	⅛—¼
400,000	"	1/3.298	1/3.298	Do 8 p.c. Pref. ...	⅛—¼
1,748,090	July 22 '40	2	3	Commercial Ord.	66—71
620,000	June 7	3	3	Do. 3 p.c. Deb.	60—65
286,344	Feb. 15	5	5	Do. 5 p.c. Deb.	108—113
807,560	" 22	6	6	Croydon alding scale	122—127
644,590	"	5	5	Do. max. div.	101—106
620,385	June " 28	5	5	Do. 5 p.c. Perp. Deb. ...	122—127
179,500	Feb. 22	5	5	East Surrey 'B,' 5 p.c.	87—92
176,461	June 28	5	5	Do. 5 p.c. Deb. (Irred.)...	121—126
250,000	July 26	4	6	Gas Consolidation Ord. 'B' ...	17/6—19/6
250,000	May 10	4	4	Do. 4 p.c. Red. Cum. Pref.	18/——20/-
19,107,811	Feb. 15	—	†1	Gas Light & Coke Ord. ...	17/6—18/6a
2,600,000	"	—	†1½	Do. 3½ p.c. max.	70—75
4,477,106	"	4	4	Do. 4 p.c. Con. Pref. ...	92—95
2,993,000	July " 12	3½	3½	Do. 3½ p.c. Red. Pref. ...	94—97
8,602,497	May 31	3	3	Do. 3 p.c. Con. Deb. ...	84—87
3,642,770	"	5	5	Do. 5 p.c. Red. Deb. ...	107—110
3,500,000	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	106—109
700,000	March 8	3½	3½	Do. 3½ Red. Deb.	96—99
5,600,000	May 13 '40	4	8	Imperial Continental Cap. ...	88—91
43,820	July 26	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100
231,978	Feb. 22	5	5	M.S. Utility 'C' Cons.	95—100
918,657	"	4	4	4 p.c. Cons. Pref.	90—95
675,000	May " 3	‡4	‡4	Montevideo, Ltd.	95—100
300,000	April 27	9	7	Oriental, Ltd.	110—115
368,537	June 15	3½	2½†	Plymouth & Stonehouse 5 p.c.	97—102
621,667	Feb. 8	7½	7½	Portsmouth & Gosport Cons.	120—125
2,381,363	May 17	4†	4†	Primitiva Holdings, Ltd. Ord.	12/——14/-
233,900	June 15	3½	3½	Do. 6½ p.c. Red. Cum. Pref.	99—104
648,999	May 31	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	20/6—21/6
597,972	March 8	4½	4½	Do. 4½ p.c. Cum. Pref. ...	20/——21/-
2,528,714	Aug. 24	1/-	7½	South East'n Gas Cn. Ld. Ord.	19/9—20/9
1,000,000	March 1	-/10½	-/10½	Do. 4½ p.c. Red. Cum. Pref.	19/9—20/9
1,068,869	"	4	4	Do. 4 p.c. Irred. Cum. Pref.	19/3—20/3
6,709,895	Feb. " 22	—	†1	South Met. Ord.	83—86
1,135,812	"	—	†6	Do. 6 p.c. Irred. Pref. ...	125—130
850,000	"	—	†4	Do. 4 p.c. irred. Pref. ...	90—95
1,895,445	June 28	3	3	Do. 3 p.c. Perp. Deb. ...	82—87
1,000,000	July 12	5	5	Do. 5 p.c. Red. Deb. ...	103—108
1,543,795	Feb. 8	4	4	South Suburban Ord. 5 p.c ...	97—102
512,825	"	5	5	Do. 5 p.c. Perp. Pref. ...	107—112
500,000	"	4	4	Do. 4 p.c. Perp. Pref. ...	88—93
250,000	"	3½	3½	Do. 3½ p.c. Red. Pref. ...	90—95
888,587	June " 15	3	5	Do. 5 p.c. Perp. Deb. ...	122—127
750,541	Feb. 8	2	6	Southampton Ord.	87—92
350,000	" 15	5½	5½	Swansea 5½ p.c. Red. Pref. ...	95—100
1,076,495	March 1	5	5	Tottenham & District Ord. ...	106—111
338,555	"	5	5	Do. 5 p.c. Pref.	106—111
453,380	June " 7	4	4	Do. 4 p.c. Perp. Deb. ...	102—107
1,247,505	May 31	4	6	U. Kingdom Gas Cor. Ord. ...	20/——21/-
1,085,952	" 17	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	19/——21/-
772,709	"	4	4	Do. 4 p.c. 1st Red. Cum.Pref.	19/——21/-
745,263	June " 21	4½	4½	Do. 4½ p.c. 2nd Non.Cum. Pf.	17/——19/-
1,200,000	March 15	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100
380,608	Aug. 24	6⅜	6⅜	Uxbridge, &c., 5 p.c.	118—123
1,371,138	Jan. 25	4	6	Wandsworth Consolidated ...	107—112
2,525,768	"	4	4	Do. 4 p.c. Pref.	91—96
1,343,964	June " 15	5	5	Do. 5 p.c. Deb.	122—127
383,745	"	4	4	Do. 4 p.c. Deb.	101—106
558,342	Feb. " 22	5	5	Watford & St. Albans Ord. ...	110—115
300,000	June 7	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95

SUPPLEMENTARY LIST

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations July 30
351,685	June 15	5	5	Brighton, &c., 5 p.c. Perp. Deb.	122—127
415,250	"	4	4	Bristol Gas Co., 4 p.c. New Deb.	100—105
140,205	July 26	7	7	Cambridge, &c., 7 p.c. Cons. 'B'	135—140
295,932	March 8	5	5	Cheltenham, 5 p.c. Cons.Ord....	97—102
42,500	June 15	4	4	Do. 4 p.c. Perp. Deb....	102—107
150,000	Feb. 22	4	4	Croydon Gas, 4 p.c. Pref. (Irr.)	90—95
130,000	June 28	4	4	Do. 4 p.c. Deb. ...	101—106
146,700	Feb. 22	5½	5½	East Surrey, 5½ p.c. Pref. 'A' ...	110—115
53,220	" 9	6	6	Do. 6 p.c. Cum. Pref. ...	120—125
...	Aug. 19 '40	6	4	Eastbourne, 'B' 3½ p.c.... ...	52—57
117,425	Feb. 5 '40	8	8	East Wight Cons. 5 p.c. ...	65—70
239,135	July 26	5	5	Gas Consolidation 'A' Ord. (£1)	16/6—18/6
156,600	Feb. 15	5	5	Hampton C't, 5 p.c. Cons. Ord.	95—100
18,000	Dec. 29 '41	3½	3½	Malta & Med'n., 7 p.c. 1st Pref.	30—40
10,845	June 30 '41	3½	3½	Do. 7½ p.c. 2nd Pref.	30—40
50,000	Feb. 22	£5 4 6	£5 4 6	Mid. South. Util., 'A' Cons. 5 p.c.	90—95
70,380	June 21	5	5	Newport (Mon.), 5 p.c. Deb...	110—115
65,000	May 17	5	5	North Middlesex, 5 p.c. Pref....	105—110
70,000	March 15	5	5	Plymouth & Stone., 5 p.c. Deb.	112—117
76,501	June 21	4	4	Reading, 4 p.c. Perp. Deb. ...	97—102
74,777	March 31	4	4	Romford, 4 p.c. Debs. (Reg.) ...	95—100
21,000	June 15	5	5	Slough, 5 p.c. Perp. Deb. ...	120—125
211,740	" 28	5	5	Southampton, 5 p.c. Red. Deb.	103—108
363,575	July 1	5	5	Tottenham, 5 p.c. Reg. Red. Mt.	99—102
202,019	April 12	7⅛	7⅛	Tunbridge Wells, 4 p.c. Scale ...	118—123
135,257	June 15	5	5	Uxbridge &c., 5 p.c. Perp. Deb.	121—126

PROVINCIAL EXCHANGES

					Quotations July 26
804,948	March 1	5	5	Bath Cons.	100—103
122,577	" 8	5	7	Blyth 5 p.c. Ord.	115—117
1,667,250	July 19	5	5	Bristol, 5 p.c. max.	112½—114½
120,420	June 15	4	4	Do. 1st 4 p.c. Deb.	100½—102½
415,250	,'	4	4	Do. 2nd 4 p.c. Deb.	100½—102½
328,790		5	5	Do. 5 p.c. Deb.	115—119
157,150	Feb' 1	5	6½	Chester 5 p.c. Ord.	98—102
92,500	June' 15	4	4	Do. 4 p.c. Pref.	78—80
36,430	"	3½	3½	Do. 3½ p.c. Deb.	77—81
41,890	"	4	4	Do. 4 p.c. Red. Deb. ...	97—99
542,270	Feb. 8	6	9	Derby Cons.	122—127
55,000	June 15	4	4	Do. 4 p.c. Deb.	97—102
10,000	Feb. 22	10	10	Great Grimsby 'A' Ord. ...	160—170
6,500	"	10	10	Do. 'B' Ord.	160—170
79,000	"	10	10	Do. 'C' Ord.	150—160
732,000	Feb. 15	4	4	Hartlepool G. & W. Cn. & New	84—86
2,167,410	" 22	5	5	Liverpool 5 p.c. Ord.	106—107
306,083	Jan. 18	4	4	Do. 4 p.c. Deb.	100—102
20,000	Dec. 21	5	5	Long Eaton 5 p.c. Pref.	9—11
80,000	"	5	5	Do. 5 p.c. Deb.	100—105
2,430,267	Feb. 8	5½	5½	Newcastle and Gateshead Con.	23/6—24/-
682,856	"	4	4	Do. 4 p.c. Pref.	98—100
776,706	June 28	3½	3½	Do. 3½ p.c. Deb.	96½—97½
277,285	April 27	5	5	Do. 5 p.c. Deb. '43 ...	99—101
13,200	Sept. 16	8⅝	7	Pontyp'l Gas & W. 10 p.c. 'A' ...	11½—12½
13,600	"	6	5	Do. 7 p.c. 'B'	9½—10½
40,000	"	5	6	Do. 7 p.c. 'C'	9½—10½
106,280	Feb. 8	10	10	Preston 'A' 10 p.c.	167—169
188,219	"	7	7	Do. 'B' 7 p.c.	124—129
1,806,339	" 22	6½	6½	Sheffield Cons.	138—142
95,000	Jan. 4	4	4	Do. 4 p.c. Deb.	98—100
332,351	Feb. 22	6	6	Sunderland 6 p.c. max.	114—116
192,150	" 8	5	5	Weston-super-Mare Cons. ...	106—108
64,338	July 5	4	4	Do. 4 p.c. Deb.	99—101
33,340	"	7½	7½	Do. 7½ p.c. Deb.	142—147

a—The quotation is per £1 of Stock. * Ex. div. † For year. ‡ Paid free of income-tax.